INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

October 18, 2005

The Honorable Annette M. Sandberg
Administrator
Federal Motor Carrier Safety Administration
400 Seventh Street S.W.
Nassif Building, Room PL – 401
Washington, D.C. 20590-0001

Electronic On-Board Recorders for Hours-of-Service Compliance;
Docket No. FMCSA-2004-18940, FMCSA-2004-17286

Dear Ms. Sandberg:

Enclosed please find a study completed by the Insurance Institute for Highway Safety on the effects of the hours-of-service rule implemented January 1, 2004 (McCartt et al., 2005). The study reports the findings of surveys of long-distance truck drivers in two states (Pennsylvania and Oregon) conducted immediately before and about a year after the rule took effect. The findings document the persistent inadequacies of the current paper-based system of enforcement. Reported violations of the work rule and falsifications of logbooks were commonplace and occurred at least as frequently in 2004, after the rule change, as in 2003. Among drivers surveyed in 2004, reported violations were associated with reported dozing at the wheel of a truck.

Electronic on-board recorders (EOBRs) provide the means to correct the inadequacies of the current enforcement system. Global positioning system (GPS) technology also is a promising method of improving drivers' compliance with the hours-of-service rule. The Institute's survey found that, although not required by law, these systems increasingly are available in the vehicle fleet. There were substantial increases between 2003 and 2004 in the number of trucks equipped with GPS (from 36 to 46 percent in Pennsylvania, 37 to 44 percent in Oregon) and trucks with EOBRs (from 19 to 41 percent in Pennsylvania, 17 to 36 percent in Oregon). However, fewer than 1 in 10 drivers with EOBRs used them to report compliance with the work rule.

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The Federal Motor Carrier Safety Administration should institute an EOBR requirement for large trucks without delay to achieve acceptable levels of rule compliance and thereby reduce fatigued driving.

Sincerely,

Anne T. McCartt

Anne T. McCartt, Ph.D.
Vice President, Research

cc: Docket Clerk, Docket No. FMCSA-2004-18940, FMCSA-2004-17286

Enclosure

McCartt, A.T.; Hellinga, L.A.; and Solomon, M.G. 2005. Work schedules before and after 2004 hours-of-service rule change and predictors of reported rule violations in 2004: survey of long-distance truck drivers. To be presented at the 2005 International Truck and Bus Safety and Security Symposium, Alexandria, VA. Arlington, VA: Insurance Institute for Highway Safety.

WORK SCHEDULES BEFORE AND AFTER 2004 HOURS-OF-SERVICE RULE CHANGE AND PREDICTORS OF REPORTED RULE VIOLATIONS IN 2004: SURVEY OF LONG-DISTANCE TRUCK DRIVERS

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Abstract: Surveys of representative samples of long-distance truck drivers in two states were conducted immediately before and about a year after the 2004 hours-of-service rule change took effect. Results indicated that the rule change resulted in substantially more hours of driving on a weekly and daily basis. Most drivers reported regularly using a restart provision, which permits a substantial increase in weekly driving and nondriving. There were increases in the proportion of drivers logging 150,000 miles or more per year and having trips longer than two weeks. Reported daily off-duty and sleep time increased. However, this additional opportunity for rest apparently did not offset the adverse effects of added work time, as reported incidents of fatigued driving and actually falling asleep at the wheel remained high. Although many drivers believed enforcement increased after the rule change, reported violations generally were as high or higher as they were under the old rule. The percentage of trucks with global positioning systems or electronic on-board recorders (EOBRs) increased significantly, but only a few drivers were using EOBRs to report rule compliance. In the 2004 survey, drivers who reported violations of the new rule were significantly more likely to report falling asleep at the wheel. Predictors of reported violations included having unrealistic delivery schedules, not sharing the driving, longer drop-off times, and difficulty finding a legal place to stop or rest. The findings indicate that the rule change has not reduced truck driver fatigue and violations of the work rules remain common. Given the persistent inadequacies of the paper-based system of enforcement, the findings support the need for an EOBR requirement to achieve acceptable levels of compliance and thereby reduce fatigued driving.

INTRODUCTION

In 2004, 5,079 deaths occurred in highway crashes involving large trucks; this represented 12 percent of all crash deaths. Anticipated increases in truck travel, coupled with increases in highway congestion and travel speeds, likely will push this toll much higher during the next decade. Truck driver fatigue is a known crash factor, although precise quantification is difficult. The federal government has estimated that truck driver fatigue is a factor in 15 percent of truck crashes involving deaths or serious injuries (65 FR 25546).

Fatigued driving results from truckers' arduous work schedules. Numerous studies have found increased crash risk among drivers operating large trucks for more than 8-10 hours (e.g., Campbell, 1988; Campbell and Belzer, 2000; Jones and Stein, 1987; Lin et al., 1993, 1994). Studies also have documented a relationship between long driving hours and reported falling asleep at the wheel of a large truck (Braver et al., 1992; McCartt et al., 1997, 2000), as well as widespread violations of federal work rules and falsifications of paper logbooks used for rule enforcement (e.g., Braver et al., 1992; Hertz, 1991; McCartt et al., 1997, 2000). Factors contributing to rule violations include pressures to adhere to tight schedules from shippers, carriers, and receivers (Beilock and Capelle, 1987; Beilock, 2003) and payment methods (e.g., payment by the mile, nonpayment for nondriving work) (Belzer, 2000).

Since 1939, federal work rules have regulated how much time interstate commercial truck drivers spend on the road and on duty. These rules are enforced primarily through roadside safety inspections conducted by state enforcement personnel. In 1995, Congress directed the U.S. Department of Transportation to open rulemaking on the hours-of-service rule to reduce truck driver fatigue and fatigue-related crashes. After nearly a decade of rulemaking, the Federal Motor Carrier Safety Administration (FMCSA) issued a new rule on April 28, 2003. The rule was implemented on January 4, 2004, but FMCSA requested that states begin full enforcement of the new rule on March 1, 2004, after 2 months of "soft enforcement."

The new rule was a substantial change (Table 1). Daily and weekly maximum driving limits and daily off-duty requirements were increased. Although the rule initially proposed in 2000 included a requirement that all trucks have electronic on-board recorders (EOBRs) to monitor driving hours, handwritten logbooks were retained for monitoring compliance. The rule change has been controversial. In response to a lawsuit filed by safety organizations, in July 2004 the

Table 1. Old and new (January 2004) work rules for commercial truck drivers.

	Old rule	New rule
Daily driving limits	10 driving hours after 8 off duty; up to 16 hours driving per 24-hour period	11 driving hours after 10 off duty; up to 14 hours driving per 24-hour period
Daily off-duty requirements	After driving 10 hours or working 15 hours, driving is not allowed again until after taking 8 hours off duty; may log off duty for breaks to extend 15-hour on-duty shift	After driving 11 hours or if 14 hours have passed since driver started duty, driving is not allowed again until after taking 10 hours off duty; may not log off duty during 14 hour on-duty shift
Sleeper berth exception	May split required 8 hours off duty into 2 periods in a sleeper berth (period must be 2 hours or more)	May split required 10 hours off duty into 2 periods in a sleeper berth (period must be 2 hours or more)
Restart provision	No provision	May restart official work week after 34 consecutive hours off
Weekly driving limits	60 hours in 7 days or 70 hours in 8 days	60 hours in 7 days or 70 hours in 8 days, but restart provision allows up to 77 hours in 7 days, 88 hours in 8 days
Work-hour limits	No daily work hour limits; no weekly work hour limits	No change
Monitoring for compliance with rules	Handwritten logbooks; voluntary use of automated recorders permitted	No change

U.S. Court of Appeals for the District of Columbia vacated the rule because it did not take into account the health and safety of drivers. The court also criticized the absence of scientific evidence to support several key aspects of the new rule. However, in September 2004 Congress intervened to keep the new rule in place until federal regulators addressed the court's concerns or until September 30, 2005, at the latest. On August 19, 2005, FMCSA issued a new rule to take effect October 1, 2005. Key changes affected short-haul operators and truckers using sleeper berths. Other aspects of the rule implemented in January 2004 remained intact. With regard to EOBRs, in September 2004 FMCSA returned to the beginning of the regulatory process with an advance notice of proposed rulemaking.

To assess the effects of the rule implemented in January 2004 on long-distance truck drivers' work schedules and reported fatigued driving, surveys of on-the-road truck drivers were conducted in two states in late fall 2003 (immediately before the rule change took effect) and 2004 (about 1 year after). This paper summarizes the key findings, including changes between 2003 and 2004 in reported work schedules, rule violations, presence of onboard monitoring equipment, perceived levels of rule enforcement, and fatigued driving. In addition, data from the 2004 survey were used to examine the association between reported rule violations and fatigued driving and between driver, carrier, and schedule characteristics and reported rule violations.

METHOD

Interviews were conducted with representative samples of drivers of large trucks passing through roadside commercial vehicle weigh stations on interstate highways in western Pennsylvania (eastbound Route I-80) and northwestern Oregon (eastbound Route I-84). In Pennsylvania, surveys were conducted during November 18-22, 2003 and November 16-20, 2004; in Oregon, surveys were conducted during December 3-6, 2003 and December 1-4, 2004.

These weigh stations are operated on most days and at various times of the day and night to enforce federal limits on truck weights. Given the heavy volume of truck traffic on these roadways, a steady stream of vehicles is weighed when the stations are open. In Pennsylvania, all trucks are required to drive over the scales. Oregon, like many states, has an automatic commercial vehicle identifier program that allows precertified participating vehicles equipped with transponders to bypass designated weigh stations, port-of-entry facilities, and other enforcement stations. Trucks in Oregon's "green light" program are weighed by an electronic scale as they approach the weigh station, and trucks in compliance are allowed to bypass the station. Approximately one-quarter of the truck traffic was "green lighted" during the two survey periods and, thus, not part of the survey sample. According to Oregon inspection staff, trucks participating in the program were primarily local rather than long-distance carriers.

Interviews were conducted when the weigh stations were open; this included weekdays and at least one weekend day, and both daylight and evening hours. When an interview was completed, inspection staff directed the next truck passing a predetermined reference point on the approach ramp to a parking lot. Trucks that were overweight, inspected, or known local trucks were excluded, but this occurred infrequently. When approaching drivers, interviewers explained they were researchers conducting a study and not enforcement staff. Drivers were asked to participate if they regularly made trips requiring them to spend at least one night away from home. To increase survey participation and elicit accurate responses, person-to-person anonymous interviews were conducted by trained interviewers, drivers were offered $10 to

participate, and interviews were described as research to determine truck drivers' schedules and opinions about the hours-of-service rule. The questionnaire was informally tested at private truck stops and formally tested at the Pennsylvania site.

Information on the effects of the rule change on work schedules, rule violations, and fatigued driving was gathered in two ways. Many questions were asked in both survey years, and differences between the 2003 and 2004 responses for these questions were examined. Some carrier and job characteristics varied by state. In addition, the distribution of sampled drivers by cargo type (own carrier, other carrier, self/other) and trailer type varied significantly between the 2003 and 2004 samples. Therefore, differences between the 2003 and 2004 results were tested using the Cochran-Mantel-Haenszel chi-square statistic after stratifying by state, cargo type, and trailer type. This statistic tests whether significant differences exist between the years for at least one of the strata. Differences were considered significant at $p < 0.05$. To gather additional information on changes in work schedules after the rule change, drivers interviewed in 2004 and with experience under both sets of rules were asked to compare their daily and weekly work schedules under the two rules. Changes between reported schedules in 2003 and 2004 are presented separately by state, and within-state changes were tested with the chi-square statistic ($p < 0.05$).

Odds ratios ($p < 0.05$) were computed to examine the strength of associations between fatigued driving and rule violations in 2004 and between rule violations and carrier, job, and driver characteristics. Analyses were conducted for each state and for the states combined (again using the Cochran-Mantel-Haenszel procedure). Because of the relatively small state samples, few findings were statistically significant; only results for the combined states are presented.

RESULTS

Approximately 350 drivers were interviewed in each state in each survey year. Overall participation rates were 96 percent in 2003 (98 percent in Pennsylvania, 93 percent in Oregon) and 91 percent in 2004 (92 percent in Pennsylvania, 90 percent in Oregon). Most drivers who declined to participate were hurrying to complete their trips. Drivers unable to speak fluent English were excluded. Drivers held their commercial driver's licenses from a broad cross-section of states; in the 2004 survey, 19 percent were licensed by Pennsylvania or Oregon, 25 percent were licensed by states bordering these two states, 52 percent were licensed by other states, and 3 percent were Canadian drivers.

Few drivers interviewed were female (1 percent in Pennsylvania and 6 percent in Oregon in 2003, 4 percent in both states in 2004). Driver age and years of experience varied little by state or year (Table 2). About 1 in 10 or fewer drivers were younger than 30, and about 1 in 10 were older than 60. More than 90 percent of drivers interviewed in both states in both years had been driving a large truck for more than 1 year.

Drivers reported logging many miles, and many regularly had trips requiring long absences from home (Table 2). In 2004, 28 percent of drivers in Pennsylvania and 42 percent in Oregon reported trips lasting more than 2 weeks, on average. The percentage of drivers logging at least 150,000 miles during the current year increased between 2003 and 2004, especially in Oregon. At least one-quarter of drivers in both states and in both surveys reported sometimes/often having unrealistic delivery times from dispatchers or shippers. More than one-half of drivers reported legal resting places often were occupied.

Table 2. Selected driver, truck, carrier, and schedule characteristics by state; interviews with long-distance truck drivers, November-December 2003 and 2004.

	Pennsylvania		Oregon	
	2003 (N=355) percent	2004 (N=356) percent	2003 (N=338) percent	2004 (N=350) percent
Driver age (years)				
21-29	5	7	11	9
30-39	22	22	22	20
40-49	35	31	33	35
50-59	28	28	27	24
60+	10	11	7	13
Years driving large trucks				
≤1	7	9	10	8
>1 to 4	12	13	16	13
>4 to 10	21	21	21	22
>10	60	57	54	56
Miles driven in current year**				
<100,000	19	18	19	15
100,000-124,000	38	33	34	30
125,000-149,000	25	27	17	18
≥150,000	18	22	29	37
Days usually on road at a stretch**				
≤5	44	40	26	22
6-7	18	16	17	18
8-14	14	16	19	19
≥15	24	28	38	42
Operator type				
Less than truckload	6	9	6	6
Full truckload	81	71	77	74
Both	13	20	17	20
Cargo hauling**				
Carrier's own cargo	18	13	10	8
Other carrier's cargo	75	83	72	88
Self/Other	8	3	18	4
Number of trucks in fleet				
0-10	21	18	29	26
11-50	22	19	22	21
51-100	10	10	12	8
101-500	22	22	8	18
>500	26	31	29	27
Trailer type**				
Dry box or bulk	50	62	47	38
Refrigerator	19	16	30	41
Flatbed	17	10	17	10
Tanker	5	4	2	3
Other	9	8	5	8
Sharing driving today with another driver	8	8	20	19
Legal resting places full				
Often	52	54	59	51
Sometimes	25	23	20	18
Rarely	16	17	15	19
Never	7	5	6	11

continued

Table 2. – Continued

	Pennsylvania		Oregon	
	2003 (N=355) percent	2004 (N=356) percent	2003 (N=338) percent	2004 (N=350) percent
Unrealistic delivery time from dispatcher or shipper				
Often	12	11	15	14
Sometimes	14	15	18	13
Rarely	32	27	27	32
Never	43	47	40	41
Typical wait for pick up				
≤30 minutes	28	31	39	23
31 minutes to 1 hour	21	20	16	22
61 minutes to 2 hours	23	24	20	23
>2 hours	28	25	25	32
Typical wait for drop off*				
≤30 minutes	37	38	48	29
31 minutes to 1 hour	21	20	20	23
61 minutes to 2 hours	22	21	17	24
>2 hours	20	21	16	24

*p<0.05, **p<0.01: Cochran-Mantel-Haenszel chi-square test indicating 2003 and 2004 differences are significant in at least one state

Carrier and truck characteristics are shown in Table 2. Refrigerator trailers were more common in Oregon, and their proportion increased in 2004. In both states, there was an increase between 2003 and 2004 in the percentage of drivers hauling cargo from another carrier versus their own carrier. A small percentage of drivers were carrying hazardous materials (5 percent in 2003 and 3 percent in 2004 in Pennsylvania, 5 percent in both years in Oregon) or pulling two or more trailers (1 percent in 2003 and 2004 in Pennsylvania, 6 percent in 2003 and 7 percent in 2004 in Oregon). Consistently, about 9 in 10 drivers were paid either by mile or by percent of load.

Work Schedules

Table 3 summarizes reported changes in typical work schedules before and after the rule change, based on drivers interviewed in 2004. Drivers who began driving a truck after October 2003 (n=62) were excluded. The new rule increased the maximum daily driving limit from 10 to 11 hours. About a fifth of drivers said they were driving more hours under the new rule; 6-7 percent said they were driving fewer hours. The percentage of daily driving shifts lasting more than 10 hours increased substantially in 2004 in both states. The new rule shortened the daily maximum duty period (including driving and nondriving work) from 15 to 14 hours and no longer allowed drivers to log off and on duty to extend their duty period. Drivers reported slight changes in their nondriving daily work hours between 2003 and 2004.

The rule implemented in 2004 increased the daily off-duty requirement from 8 to 10 hours and retained a provision allowing drivers to split this time into two periods (each at least 2 hours) in a sleeper berth. About a quarter of drivers said they typically split their off-duty period in 2004 (Table 3). Thirty-one percent of drivers in Pennsylvania and 24 percent in Oregon reported they took more off-duty time in 2004 compared with 2003; the percentage taking at least 10 hours off increased significantly in both states. Nevertheless, about a quarter reported they typically took fewer than the required 10 hours off duty in 2004, and the majority of these drivers typically took fewer than 8 hours off duty. A sizable percentage of drivers in both states (35 percent in Pennsylvania, 21 percent in Oregon) said they typically got more daily sleep under the new rule.

Table 3. Typical schedule before and after new work rule among drivers with at least 1 year commercial driving experience; interviews with long-distance truck drivers, November-December 2004.

	Pennsylvania (N=323) percent		Oregon (N=319) percent	
Change in hours in daily driving shift				
More	22		17	
Less	6		7	
About the same	72		76	
Number hours of driving in daily shift	**Old**	**New****	**Old**	**New****
≤10 hours	77	62	68	58
10.1-11 hours	11	30	18	29
>11 hours	11	8	14	13
Change in nondriving work time in daily shift				
More	4		4	
Less	7		3	
About the same	89		93	
Number hours of nondriving work in daily shift	**Old**	**New**	**Old**	**New**
≤1 hours	41	39	51	51
1.4-2.4 hours	29	32	24	26
≥2.5 hours	30	29	25	24
Change in off-duty time in daily shift				
More	31		24	
Less	8		5	
About the same	60		71	
Number hours off-duty in daily shift	**Old**	**New****	**Old**	**New****
<8 hours	24	21	17	16
8-9.9 hours	21	5	19	6
≥10 hours	55	74	64	78
Split daily off-duty rest time	25		28	
Change in daily actual sleep time				
More	35		21	
Less	7		4	
About the same	58		75	
Number hours of actual sleep daily	**Old**	**New****	**Old**	**New**
<8 hours	51	39	47	41
8-9 hours	41	41	41	41
>9 hours	9	21	13	19
Change in daily nap time				
More	23		14	
Less	17		13	
About the same	61		73	
Change in time spent waiting to pick up or drop off deliveries				
More	7		8	
Less	21		19	
About the same	72		74	
Change in number of miles driving				
More	24		20	
Less	11		7	
About the same	65		73	

**p<0.01: chi-square test of within-state differences

In the 2003 and 2004 surveys, drivers were asked about typical wait times for pick ups and drop offs (Table 2). Responses included some very long wait times; it is possible that some may have included the required off-duty time. Typical pick-up and drop-off times in 2003 and 2004 varied only a little in Pennsylvania. Times in Oregon were longer in 2004 than in 2003, but only the difference for drop offs was significant. On a separate item in the 2004 survey, drivers who had worked under both rules were asked whether typical pick-up and drop-off times had changed in 2004 versus 2003 (Table 3). One-fifth of drivers in both states said they were less, and 7-8 percent said it was more. Thus, findings with regard to wait times appeared inconsistent.

In the rule change, weekly driving limits of 60 hours in a 7-day period or 70 hours in an 8-day period were retained. However, with a new restart provision, when the weekly limit is reached (even if reached in fewer than 7 or 8 days) drivers can resume driving toward a new 60/70-hour limit after taking a "recovery period" of 34 hours off duty. Use of the restart provision allows up to 77 hours of driving in 7 days and up to 88 hours of driving in 8 days, increases of 28 and 26 percent, respectively. More than 90 percent of drivers reported they used the restart provision during 2004, and a large majority said it was part of their regular schedules (Table 4). Nine percent of drivers in Pennsylvania and 16 percent in Oregon said they take off fewer than 34 hours before beginning a new weekly shift; about a fifth in each state said they take 34 hours.

Table 4. Use of restart provision and off-duty time between weekly shifts, interviews with long-distance truck drivers, November-December 2004.

	Pennsylvania (N=356) percent	Oregon (N=350) percent
Number of hours off duty before begin new weekly shift		
<34 hours	9	16
34 hours	19	21
34.1-47.9 hours	31	21
≥48 hours	41	41
Ever use restart rule	92	93
Restart provision part of regular schedule	85	75

Of some interest is the extent to which drivers have used both the additional hour of daily driving allowed under the rule change (from 10 to 11 hours) and the restart rule. The percentage of drivers who said their typical schedules included a daily driving shift of more than 10 hours and the restart rule was 36 percent in Pennsylvania and 30 percent in Oregon (table not shown).

Fatigued Driving

The percentage of drivers who said they drove their trucks while sleepy at least once during the past week increased after the rule change in Pennsylvania (43 to 48 percent) and did not change in Oregon (36 percent) (Table 5). The percentage who reported actually dozing at the wheel of a truck on at least one occasion during the past month increased slightly in both states (13 to 16 percent in Pennsylvania and 12 to 14 percent in Oregon). These differences were not significant.

Compliance with Work Rule

Reported rule violations were common, and violations in both states generally were at least as prevalent in 2004 as in 2003 (Table 5). For example, the percentage who reported working longer than the rule permitted in the past month increased slightly from 25 to 28 percent in

Table 5. Reported fatigued driving and violations of work rules; interviews with long-distance truck drivers, November-December 2003 and 2004.

	Pennsylvania		Oregon	
	2003 (N=355) percent	2004 (N=356) percent	2003 (N=338) percent	2004 (N=350) percent
Drove sleepy at least once in past week	43	48	36	36
Dozed at wheel at least once in past month	13	16	12	14
Drive more than 10 hours (2003) or 11 hours (2004) before taking required off-duty time				
Often	5	7	11	13
Sometimes	14	15	14	15
Rarely	25	26	19	20
Never	56	53	56	52
Drive after being on duty 14 hours				
Often	—	6	—	8
Sometimes	—	12	—	11
Rarely	—	19	—	16
Never	—	63	—	65
Take fewer than 8 hours (2003) or 10 hours (2004) off duty				
Often	9	12	10	11
Sometimes	15	15	14	14
Rarely	22	21	17	16
Never	55	52	59	60
Drive more than weekly limit before taking required off-duty time**				
Often	6	4	9	7
Sometimes	9	7	10	9
Rarely	22	15	22	17
Never	63	74	59	68
Omit hours worked in logbook				
Often	12	17	19	21
Sometimes	18	13	17	15
Rarely	18	21	21	19
Never	52	50	43	45
Worked longer than rules permitted during last month	25	28	30	32
Logbooks generally accurate for most drivers	32	38	35	38

**p<0.01: Cochran-Mantel-Haenszel chi-square test indicating 2003 and 2004 differences are significant in at least one state

Pennsylvania and from 30 to 32 percent in Oregon. An exception to this pattern was that a larger percentage of drivers in 2004 than in 2003 said they never exceeded the weekly driving limit; the restart provision allows drivers to begin a new weekly driving clock after 34 hours off duty.

On-Board Technologies and Perceived Enforcement

The new rule did not include a requirement for the use of EOBRs to demonstrate compliance to enforcement officers. Between 2003 and 2004, there was a large and significant increase in the percentage of drivers with global positioning systems (GPS), and the percentage of drivers with EOBRs more than doubled in both states (Table 6). In both survey years, almost all drivers with EOBRs also maintained paper logbooks for inspection purposes. Among drivers who had worked under both rules, a substantial proportion in both states (40 percent in Pennsylvania, 28 percent in Oregon) said enforcement of the rule had increased in 2004 (table not shown). Six percent in each state said enforcement had declined.

Table 6. Presence of global positioning system or electronic on-board recorders on truck; interviews with long-distance truck drivers, November-December 2003 and 2004.

	Pennsylvania		Oregon	
	2003 (N=355) percent	2004 (N=356) percent	2003 (N=338) percent	2004 (N=350) percent
Global positioning system (GPS)*	36	46	37	44
Electronic onboard record or other onboard computer*	19	41	17	36
If yes, also keep paper logbook	91	95	91	93

*p<0.05: Cochran-Mantel-Haenszel chi-square test indicating 2003 and 2004 differences are significant in at least one state

Predictors of Rule Violations

Using data from the 2004 survey, analyses examined the association between reported violations of the 2004 rule and falling asleep at the wheel at least once during the past month and the associations between driver, carrier, and schedule characteristics and reported violations. Adjusted odds ratios (ORs) and 95 percent confidence intervals (95% CIs) for a given predictor represented the increase or decrease in the odds of violations or dozing at the wheel, after accounting for effects of state differences. Predictors included the variables listed in Table 2. Six violation measures included violating the daily 11-hour driving limit, daily 10-hour off-duty requirement, daily 14-hour duty limit, or weekly 60/70-hour driving limit (yes vs. no); omitting hours worked in the logbook (yes vs. no); and working longer than rules permitted in the past month (yes vs. no). A dichotomous variable was created for each of the first five violation measures (Table 5), so that rarely/sometimes/often violating the rule was compared with never violating the rule.

Reported rule violations were significantly associated with dozing at the wheel of a truck during the past month (table not shown). The likelihood of dozing was significantly higher for drivers who violated the work rules during the past month (OR = 1.82, 95% CI = 1.19-2.78) or who (either rarely, sometimes, or often) omitted hours from their logbooks (OR = 1.67, 95% CI = 1.10-2.56), violated the daily 11-hour driving limit (OR = 2.27, 95% CI = 1.47-3.45), violated the daily 14-hour work shift rule (OR = 2.27, 95% CI = 1.49-3.45), or violated the required minimum daily 10-hour off-duty period (OR = 1.92, 95% CI = 1.25-2.94). Reported violation of the weekly driving limit was not a significant predictor (OR = 1.04, 95% CI = 0.67-1.64).

Table 7 summarizes odds ratios for rule violations by carrier, truck, and schedule predictors that were significantly associated with at least one violation measure. Odds ratios that were significant are highlighted. The odds of rule violations were consistently and significantly higher for drivers who said they ever had unrealistic delivery schedules from a shipper or receiver, not sharing driving with another driver on the trip, and typical drop-off times of more than 1 hour vs. 30 minutes or less. Finding rest areas full rarely/sometimes/often was a significant predictor of four of the six violation measures. Compared with hauling a dry box or bulk trailer, hauling a refrigerated trailer significantly increased the odds of violations for five of the six measures; hauling a flatbed trailer vs. a dry box/bulk trailer also increased the odds, but this was significant only for violations of the daily 14-hour duty limit and omitting hours worked from the logbook. Fleet size, pick-up wait times, and full- vs. less-than-truckload carrier were not consistently strong predictors of violations, although drivers working for full-truckload carriers were half as likely to report omitting hours from their logbooks. Nonsignificant predictors not included in

Table 7. Adjusted odds ratios (95% confidence intervals) for violations of 2004 hours-of-service rule by carrier, truck, and schedule characteristics, adjusted for state; interviews with long-distance truck drivers, November-December 2004.

	Violated rules in past month	Drive more than 11 hours daily	Take fewer than 10 hours off duty daily	Drive after 14 hours on duty	Drive more than weekly limit	Omit hours in logbook
Days on road						
5 days or fewer	1.00	1.00	1.00	1.00	1.00	1.00
6-7 days	1.06 (0.64-1.76)	1.08 (0.68-1.70)	1.54 (0.97-2.44)	1.00 (0.63-1.61)	2.16 (1.30-3.60)	1.33 (0.95-3.64)
8-14 days	1.25 (0.77-2.05)	1.30 (0.83-2.05)	1.40 (0.89-2.20)	1.22 (0.77-1.95)	2.30 (1.39-3.81)	1.20 (0.76-1.89)
>14 days	0.98 (0.64-1.49)	0.75 (0.51-1.10)	0.70 (0.47-1.03)	0.72 (0.48-1.07)	1.51 (0.88-3.16)	1.04 (0.71-1.52)
Trailer Type						
Dry box or bulk	1.00	1.00	1.00	1.00	1.00	1.00
Refrigerator	1.86 (1.26-2.76)	2.08 (1.44-3.01)	1.89 (1.30-2.75)	1.46 (1.00-2.14)	1.73 (1.17-2.58)	1.92 (1.32-2.78)
Flatbed	1.29 (0.73-2.28)	1.51 (0.90-2.52)	1.17 (0.69-1.99)	2.10 (1.24-3.54)	1.32 (0.75-2.32)	2.23 (1.31-3.81)
Tanker	1.04 (0.42-2.54)	1.53 (0.70-3.35)	0.86 (0.38-1.95)	0.90 (0.38-2.12)	1.05 (0.43-2.57)	0.70 (0.31-1.58)
Other	1.10 (0.55-2.17)	1.03 (0.56-1.91)	1.22 (0.66-2.28)	1.22 (0.64-2.30)	0.90 (0.44-1.84)	1.56 (0.85-2.87)
Fleet size						
0-10 trucks	1.00	1.00	1.00	1.00	1.00	1.00
11-50 trucks	1.51 (0.91-2.48)	2.04 (1.26-3.30)	1.54 (0.96-2.49)	1.14 (0.70-1.85)	1.87 (1.13-3.10)	1.14 (0.71-1.85)
51-500 trucks	1.08 (0.68-1.73)	1.19 (0.77-1.84)	1.18 (0.76-1.83)	1.02 (0.65-1.59)	1.09 (0.67-1.77)	0.69 (0.44-1.06)
>500 trucks	0.89 (0.55-1.43)	0.83 (0.53-1.28)	0.78 (0.50-1.21)	0.73 (0.46-1.15)	1.00 (0.61-1.62)	0.69 (0.44-1.07)
Full-truckload vs. less-than-truckload carrier	0.75 (0.42-1.37)	0.97 (0.55-1.70)	1.11 (0.62-1.97)	0.72 (0.41-1.28)	0.84 (0.45-1.54)	0.52 (0.29-0.96)
Parking spots full (rarely/sometimes/often vs. never)	1.47 (0.78-2.78)	1.79 (1.01-3.12)	3.23 (1.67-6.25)	2.38 (1.20-4.55)	3.12 (1.45-6.67)	1.19 (0.68-2.04)
Unrealistic delivery time (rarely/sometimes/often vs. never)	3.03 (2.13-4.35)	2.63 (1.92-3.57)	2.38 (1.75-3.33)	2.27 (1.67-3.12)	3.12 (2.17-4.55)	2.38 (1.75-3.23)
Share driving (no vs. yes)	3.53 (1.88-6.64)	4.47 (2.63-7.62)	3.03 (1.81-5.06)	2.93 (1.68-5.10)	3.49 (1.86-6.57)	2.12 (1.34-3.33)
Pick-up wait time						
30 minutes or less	1.00	1.00	1.00	1.00	1.00	1.00
31 minutes to 1 hour	0.85 (0.51-1.41)	1.03 (0.66-1.59)	0.64 (0.41-1.01)	1.18 (0.75-1.86)	0.71 (0.43-1.18)	1.04 (0.67-1.60)
61 minutes to 2 hours	1.43 (0.90-2.27)	1.58 (1.03-2.40)	1.36 (0.89-2.08)	1.29 (0.83-2.00)	1.31 (0.83-2.06)	1.95 (1.27-2.98)
>2 hours	1.66 (1.06-2.62)	1.30 (0.87-1.94)	1.29 (0.86-1.94)	1.40 (0.92-2.14)	1.28 (0.83-1.99)	1.91 (1.27-2.88)
Drop-off wait time						
30 minutes or less	1.00	1.00	1.00	1.00	1.00	1.00
31 minutes to 1 hour	1.46 (0.92-2.34)	1.20 (0.79-1.83)	0.99 (0.64-1.53)	1.29 (0.83-1.99)	1.33 (0.84-2.13)	1.17 (0.77-1.77)
61 minutes to 2 hours	1.69 (1.07-2.68)	1.49 (0.99-2.23)	1.94 (1.28-2.93)	1.40 (0.92-2.14)	1.59 (1.01-2.50)	2.23 (1.47-3.38)
>2 hours	2.16 (1.38-3.39)	1.82 (1.21-2.74)	1.86 (1.23-2.81)	1.76 (1.15-2.68)	1.75 (1.12-2.75)	2.33 (1.53-3.53)

Results in highlighted cells are statistically significant

Table 7 included estimated miles driven in 2004, type of cargo hauled (own carrier vs. other carrier), whether owner-operator, and splitting daily off-duty period. Associations between reported violations and hauling hazardous materials or method of pay could not be examined because of the minimal variation in responses, as noted above.

With regard to driver characteristics, age was not a strong predictor of violations. Generally, drivers ages 50-59 and drivers 60 and older were least likely to report violations, and drivers ages 30-39 were most likely; however, these differences rarely were significant. More years of experience was associated with a higher likelihood of reported violations except for exceeding the weekly driving limit. For the other violation measures, the odds of violations were at least doubled for drivers with more than 4 years of experience vs. drivers with 1 year or less experience. Drivers with more than 1 year but fewer than 4 years experience also were more likely to report violations than drivers with up to 1 year of experience, but not significantly so. Gender differences could not be examined because of the very small sample of female drivers.

DISCUSSION

Truck driver fatigue is an important risk factor in serious and fatal crashes. The work rule change implemented in January 2004 followed nearly a decade of rulemaking undertaken to meet a Congressional directive to reform the work rule to reduce truckers fatigued driving and fatigue-related crashes. Effects of the rule change on crashes can be determined only through scientific study examining crashes involving trucks from a representative sample of carriers over a long period of time and controlling for other potential crash factors such as economic trends and travel patterns. Out-of-service rates are useful measures of compliance and enforcement but are not evidence of safety by themselves, especially when based on selected carriers with good safety records. At this juncture, pertinent information to assess rule change effects is evidence of changes in drivers' schedules, fatigued driving, and compliance. This paper provides such evidence, based on interviews with long-distance truck drivers immediately before the new rule took effect in January 2004 and about 1 year after. The results indicate safety was not enhanced as a result of the rule change; drivers were driving more hours on a daily and weekly basis, and fatigued driving was at least as common as before the rule change.

The 2004 rule change was opposed by most safety organizations and remains highly contentious. Efforts to improve work rules are meaningless without effective enforcement, and there is little disagreement that the current enforcement system is inadequate. Numerous studies reported the prior rule was widely flouted and logbooks frequently falsified (e.g., Braver et al., 1992; McCartt et al., 1997). In the research reported here, drivers believed enforcement increased after the rule change. However, reported noncompliance with the new rule remained widespread and at similar levels as under the old rule. Consistent with surveys of drivers working under the old rule (Braver et al., 1992; McCartt et al., 1997), violations of the 2004 rule were associated with reported dozing at the wheel. Also consistent with these earlier surveys, a number of schedule and carrier characteristics were predictive of reported violations, including having a tight delivery schedule, not sharing the driving with another driver, longer drop-off wait times, and driving a refrigerated trailer. Between 2003 and 2004, the percentage of drivers with GPS or EOBRs increased substantially even though these systems are not required by law. However, EOBRs rarely were used to show compliance with the rules. Taken together, these findings provide further support that requiring EOBRs in all large trucks is perhaps the single most critically needed hours-of-service reform.

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